Name: ____________________ Date: ____________

Polynomial Operations SOLUTION (version 101)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$\begin{aligned} p(x) &= -7x^5 - 2x^3 + 10x^2 - 5x + 4 \\ q(x) &= -9x^5 - 3x^4 - 10x^3 - 2x^2 + 6 \end{aligned}$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-7)x^5 + (0)x^4 + (-2)x^3 + (10)x^2 + (-5)x^1 + (4)x^0 \\ q(x) &= (-9)x^5 + (-3)x^4 + (-10)x^3 + (-2)x^2 + (0)x^1 + (6)x^0 \\ p(x) + q(x) &= (-16)x^5 + (-3)x^4 + (-12)x^3 + (8)x^2 + (-5)x^1 + (10)x^0 \\ p(x) + q(x) &= -16x^5 - 3x^4 - 12x^3 + 8x^2 - 5x + 10 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$\begin{aligned} a(x) &= 6x^2 + 8x + 7 \\ b(x) &= 6x + 3 \end{aligned}$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$6x^2$	$8x$	7
$6x$	$36x^3$	$48x^2$	$42x$
3	$18x^2$	$24x$	21

$$a(x) \cdot b(x) = 36x^3 + 48x^2 + 18x^2 + 42x + 24x + 21$$

Combine like terms.

$$a(x) \cdot b(x) = 36x^3 + 66x^2 + 66x + 21$$

3. Express $(x+1)^6$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^6 + 6x^5 + 15x^4 + 20x^3 + 15x^2 + 6x + 1$$

Polynomial Operations SOLUTION (version 101)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -x^3 + 6x^2 + 13x + 14 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & -1 & 6 & 13 & 14 \\ 8 & & -8 & -16 & -24 \\ \hline & -1 & -2 & -3 & -10 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = -x^2 - 2x - 3 + \frac{-10}{x-8}$$

In other words, $h(x) = -x^2 - 2x - 3$ and the remainder is $R = -10$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -x^3 + 6x^2 + 13x + 14$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (-1)\cdot(8)^3 \ + \ (6)\cdot(8)^2 \ + \ (13)\cdot(8) \ + \ (14) \\ &= (-1)\cdot(512) \ + \ (6)\cdot(64) \ + \ (13)\cdot(8) \ + \ (14) \\ &= (-512) \ + \ (384) \ + \ (104) \ + \ (14) \\ &= -10 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x-8$. Thus, $f(8) = -10$.